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Original Research Article

Knowledge and Attitude of Medical Students toward the Risks of Formaldehyde in the Dissection Room: A Survey Study

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ABSTRACT

Background: Formaldehyde (FA) is used to keep the cadavers from decomposition. Medical students are at higher risk of exposure to formalin during anatomy practical sessions. The study aimed to assess the awareness of medical students at Al-Neelain University in Sudan regarding the health risks of FA exposure, and to inform interventions to improve safety practices in the medical training environment.

Material and Methods: A descriptive cross-sectional institutional-based study was conducted among second-year medical students, at the Faculty of Medicine, Al-Neelain University, Khartoum, Sudan, during the academic year from March 2023 to September 2023. A structured questionnaire was developed to assess the student's knowledge, attitudes, and sources of information regarding the hazards of FA exposure. The collected data were analyzed using SPSS version 26.0 with t-tests and chi-square tests were applied to ascertain statistical significance.

Results: This cross-sectional study involved 147 medical students, comprising a predominantly 88 females (59.9%) and 59 males (40.1%). An assessment of the participants' comprehension of the potential hazards associated with FA exposure revealed that the majority exhibited a fair level of knowledge (68.0%), while smaller proportions demonstrated either a good (16.3%) or poor (15.6%) knowledge. Regarding attitudes, the data indicated that the overwhelming majority harbored a positive, or "good", disposition (85.0%), in contrast to the minority who expressed fair (10.9%) or poor (4.1%) attitudes. The primary sources of information were cited as colleagues (44.9%) and academic literature (26.5%). Notably, no significant differences in knowledge and attitudes were found between genders, P= 0.735, and P= 0.368 respectively.

Conclusion: Majority of medical students had fair knowledge about the risks of FA but exhibited a predominantly positive attitude towards the hazards.

KEYWORDS: Formaldehyde, Medical Students, Dissection, Knowledge, Attitude.

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INTRODUCTION

To preserve cadavers for instructional purposes, it is crucial to prevent their decomposition by using preservation techniques such as embalming and plastination. Formaldehyde (FA) is the most commonly used chemical for this purpose. Exposure typically occurs through inhalation or skin contact with FA-containing liquids [1]. However, FA is known to be carcinogenic [2], toxic [3,4], and allergenic [5]. Medical students and instructors are at higher risk of exposure to formalin due to their duties in the dissection room of the anatomy department. The air in such an environment is saturated with preservation solutions and evaporated formalin from cadavers or their containers. The effects of FA depend on the duration of exposure during practical sessions, the working environment, and the type of embalming used [6]. FA is classified as a carcinogenic substance linked to leukemia and nasopharyngeal cancer. Inhalation exposure has been shown to cause severe health issues in animal models, including dyspnea, muscle spasms, hypersalivation, vomiting, and even death [7]. A study at a tertiary institution in Nigeria found that FA exposure negatively impacts medical students' respiratory conditions, causing decreased pulmonary functions and increased respiratory rate [8]. Another study at Wollo University in Ethiopia revealed that FA exposure during cadaveric dissection can cause symptoms like nasal discharge, excessive tearing, headaches, unpleasant odors distractibility, and fatigue [9]. In addition to increasing the risk of nasopharyngeal carcinoma and leukemia, FA exposure can cause irritation of the upper respiratory tract and eyes [10].

The Anatomy Department at SMBT Institute of Medical Sciences and Research Center conducted a study on formalin exposure among first-year medical students, revealing adverse effects including headache, lacrimation, redness, burning, and eye itching [11].

A similar study at Medical College, Santosh University found that first-year MBBS students experienced symptoms related to FA vapors from cadavers in the dissection hall, including a runny nose, dryness, congestion, an unpleasant odor, dry cough, sore throat, redness, excessive tearing, itching, and blurred vision, and another symptoms [12]. A study found that students had positive reported of using cadaveric dissection for anatomy practical teaching, citing its benefits in the retention of theoretical information, understanding, skill enhancement, anxiety reduction, and increased confidence in future practice [13]. The lack of research on students' awareness and attitudes toward occupational health and safety protocols increases their vulnerability to potential overexposure, highlighting the need for enhanced knowledge and attitudes. This study aimed to investigate medical students' knowledge and attitudes regarding the risks associated with FA exposure.

MATERIALS AND METHODS

A descriptive cross-sectional institutional-based study was carried out at the Faculty of Medicine, Al-Neelain University, Khartoum, Sudan. Al-Neelain University Research Ethics Committee (AU-REC) approved the study on date 06/02/2023 by the number AU-REC/02-2023/06. The study included second-year medical students, from March 2023 to September 2023.

Inclusion Criteria: Students who attended practical anatomy classes were eligible to participate in the study which was also contingent on the student's acceptance and consent.

Exclusion Criteria: Students who did not attend the gross anatomy practical classes in the dissection room, as they were not exposed to FA, and those who were not interested in participation.

Sample Size: The Faculty of Medicine has 200 second-year students. Assumed an expected proportion of 50% (0.5), confidence level 95%, and margin of error 5%. Using the sample size calculation formula for a finite population, resulted in 132 students, to account for potential errors or non-responses this number was increased by 10%. Therefore, the minimal recommended sample size for the current study had been set at 145 participants.

Th applied formula was:

$$n = (Z^2\ p\ (1-p)) / (e^2 + (Z^2\ p\ (1-p)) / N)$$

where n = sample size, Z = z-score for the desired confidence level (1.96 for 95% confidence), p = expected proportion, e = margin of error, and N = population size [14].

Methodology and Data Collection: The researchers designed a structured questionnaire to evaluate the hazards of FA exposure, as well as participants' knowledge, attitudes, and sources of information. The questionnaire was converted into an online Google Form and sent to the target population via email, with regular reminders to ensure timely responses. The survey collected 147 responses and categorized knowledge and attitude into three levels: fair (51%-69%), good (70% or above), and poor (50% or less).

Data Analysis: The data were managed statistically utilizing the SPSS package for Windows, IBM Corp, Armonk, NY, USA, version 26.0. A P value of less than 0.05 was considered statistically significant. T-test and Chi-square test were used.

RESULTS

The study involved a total of 147 students, of which 88 (59.9%) were females and 59 (40.1%) were males. The majority of the participants, 129 (87.8%), were in their fourth semester, while the remaining 18 (12.2%) were in their third semester.

Table 1: Shows the distribution of participants according to their knowledge concerning the risks of FA, n=147.

Score	Frequency	Percent
Poor	23	15.7
Fair	100	68
Good	24	16.3

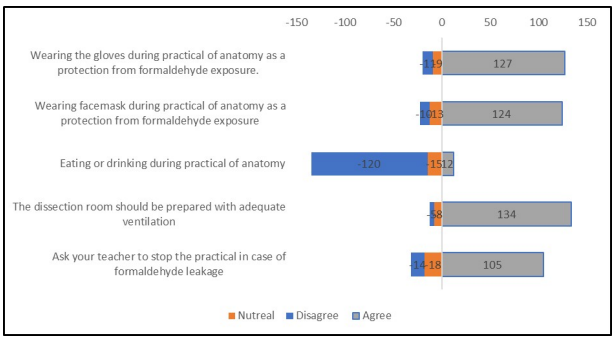

Fig. 1: Shows the response of the participants to their attitude toward the risks of FA exposure.

Students' knowledge towards risks of the FA: Students' knowledge regarding the risks of FA was evaluated, it was found that the majority of the participants had fair knowledge (68.0%), followed by good knowledge (16.3%), and poor knowledge (15.6%), as in Table 1.

Students' attitude towards risks of the FA: Students' attitude regarding the risks of FA was evaluated, it was found that, the majority of participants had good (positive) attitude 125 (85.0%), followed by those who had fair attitudes 16 (10.9%), and a small number had poor (negative) attitudes 6 (4.1%), Figure 1.

The sources of information on the risks of the FA: The study findings revealed that the most common sources of information about the dangers of FA are colleagues (44.9%), literature reviews (26.5%), and together colleagues and literature reviews (28.6%) as in Table 2. Regarding other sources of information such as lectures, tutorials, and practical sessions in college, it was found that 90.5% had not learned about the risk of FA and 9.5% had learned in college as in Table 2.

Table 2: Shows the distribution of participants based on their sources of information and whether they learned about the risks of FA through lectures, tutorials, and practical sessions during their college education (n=147).

Sources of information	Frequency	Percentage
Literature review	39	26.50%
Colleagues	66	44.90%
Both	42	28.60%
Other sources of information	**Frequency**	**Percentage**
learned in college (lectures, tutorials, and practical sessions)	14	9.50%
Not learned in college	133	90.50%

Gender differences in knowledge and attitudes towards the risk of FA: It was discovered that there was no noticeable difference between genders in terms of knowledge and attitudes regarding risk OF FA exposure, P = 0.735; P = 0.368 respectively.

DISCUSSION

In educational environment, student health and safety are crucial. Unsafe conditions can significantly contribute to poor learning experiences. One of the most frequent risks that

medical students face during their anatomy practical sessions is exposure to the adverse effects of formaldehyde. Awareness and adequate knowledge about these hazards are crucial prerequisites for every medical student. In this study, medical students' attitudes and knowledge regarding FA exposure were evaluated. The results offer important new perspectives on the sources of information, students' knowledge levels, their attitudes, and potential gender differences in this domain. Colleagues emerged as the primary source of information regarding FA risks, followed by literature reviews. This highlights the significance of peer influence and self-directed learning among medical students. However, it's concerning that the majority of students had not received formal education on FA risks through lectures, tutorials, or practical sessions in college. This underscores a gap in the curriculum that needs to be addressed to ensure comprehensive education on FA hazards.

The current study revealed varying levels of knowledge among participants, with a majority demonstrating fair knowledge followed by good knowledge. This suggests a decent baseline understanding of FA risks among medical students. These findings differ somewhat from a survey conducted among medical student by the department of medicine at Copperbelt University which revealed that (63.9%) of respondents had little to no knowledge about formalin's effects compared to an average of (34%) and a knowledgeable (2.1%.) [15].

Another study at South Valley University on first- and second-year students who regularly encounter formalin during their anatomy course aimed to highlight the symptoms of formalin toxicity that students experience after exposure to FA in dissection rooms. The findings of this study showed that almost (85%) were aware that formalin exposure might have negative health effects, (12.6%) were unsure, and only (2.4%) did not anticipate that exposure to formalin would be harmful to their health, in addition, the majority, 96.5% were not provided with training or informational courses on how to protect themselves [16].

A study conducted among laboratory workers to assess their awareness and perception of occupational exposure to chemical substances, the result concluded that there are substantial knowledge gaps and a lack of readiness regarding safety practices [17].

In our study, the majority exhibited a positive attitude towards these risks, indicating a willingness to acknowledge and address hazards associated with FA exposure. These findings are encouraging, as they suggest that medical students are receptive to information regarding occupational safety and are inclined towards adopting precautionary measures. The Copperbelt university faculty of medicine study found that only (2.8%) of students exercised extreme caution, compared to 75.2% who took moderate precautions and this goes with our findings [15]. However, A study in Ethiopia found that permanent workers had better knowledge and attitudes about FA hazards [18], possibly due to their increased awareness of chemical risks compared to students.

Interestingly, the study found no significant gender differences in both knowledge and attitudes towards FA risks, this suggests that regardless of gender, Medical students exhibit similar awareness and attitudes towards FA hazards, indicating that universal educational interventions targeting FA safety measures can be implemented. The study reveals no significant correlation between students' knowledge of occupational risks of the FA and their sources of information, as these sources are not officially included in the curriculum to meet educational objectives.

Although it seems that there is no significant relationship between the sources of information about the occupational risks of FA and students' attitudes toward safety measures, those with a fair attitudes show significant relationship when directly were asked whether they learned about these risks through lectures, tutorials, or practicals at college, this supports that the knowledge gained through the studied academic method enables students to reach the goals of this knowledge and apply it practically. A study in Lahore, Pakistan, found that nurses have a high level

of knowledge and positive attitude regarding occupational hazards, with a score of 67.5% and 56.91% respectively [19], This findings is somewhat consistent with our results. Another study among Nigerian healthcare providers revealed that 81.8% had good knowledge of occupational hazards, while medical students lacked this knowledge compared to trained healthcare providers [20]. The present survey study evaluated medical students' knowledge and attitudes regarding the adverse effects of the FA. To mitigate these effects, we recommend enriching the curriculum to include greater awareness of the hazards associated with FA and other harmful materials that students may encounter during their education.

CONCLUSION

The study's findings have several implications for medical education and occupational health practices. Firstly, there is a need for enhanced integration of occupational health topics, including FA risks, into medical curricula. Formal education through lectures, tutorials, and practical sessions can bridge the existing gap in students' knowledge. Additionally, promoting peer-led discussions and encouraging students to engage in literature reviews can further augment their understanding of these hazards. Furthermore, fostering a positive attitude towards safety measures and risk mitigation strategies is crucial.

Author Contributions

Yousif Balla: Conceptualization and Design, **Abdalla Ahmed Eldaw Elamin**: Writing-original draft, **Nasreldin Marhoum Ahmed:** Revisiting Critically, **Mohamed Anas Patni:** analyze and interpreting the data, **Naveen Kumar:** Investigation, Writing-review & editing **Saadeldin Ahmed Idris:** Revise and editing the Manuscript

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